AN EXTENDED FRAMEWORK FOR IMPLEMENTING OF ENTERPRISE RESOURCE PLANNING FOR SMALL AND MEDIUM ENTERPRISES

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A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy (Mechanical Engineering)

Faculty of Mechanical Engineering
Universiti Teknologi Malaysia

JULY 2013

Dedicated to:

My parents and my wife,

for their hope, support and encouragement.

My daughter, Pardis and my son, Amir Mohammad

for their cheerfulness and soulfulness

ACKNOWLEDGEMENTS

Firstly, I wish to express my heartfelt gratefulness to the Almighty Allah (S.W.T) for the blessing and strength which He blessed me with during the completion of this research.

My sincerest gratitude goes to my main supervisor Associate Prof. Dr. Muhamad Zameri Mat Saman for his continuous support for my PhD study and research, for his motivation, advice, patience, enthusiasm and immense knowledge and my co-supervisor Associate Prof. Dr. Wong Kuan Yew for his guidance and advice and his encouragement from the beginning to the completion of the present research. Without their continued support and interest, this thesis would not have been completed. Furthermore, I am very grateful to Prof. Dr. Hooshang M. Beheshti for his support and motivation. I would also like to thank my earlier supervisor Prof. Dr. Ashraf Hafiz Amin Radwan.

I am also grateful to my family, especially my wife, for her support and psychological encouragement and the preparation of a quiet environment for my studies. Also, I am thankful to my children for their patience. The very genuine appreciation goes to my parents, who always motivated me.

Lastly, I would like to thank the staff of Mechanical Engineering Faculty, Universiti Teknologi Malaysia for their help and support.

ABSTRACT

Enterprise Resource Planning (ERP) has been used in developed countries to integrate the information and to support decision making in business improvement and competition globally. Many frameworks, models and methods were proposed and applied clearly intended for large companies. Many Small and Medium Enterprises (SMEs) have difficulties when implementing and adopting the ERP systems that resulted in failures. The objective of this research is to formulate a new framework for SMEs implementing the ERP project with a view of highlighting the enterprise architecture and Critical Success Factors (CSFs) as the foundation for ERP systems for substantial improvement in success rate of projects. The CSFs of ERP projects were derived using literature and questionnaire survey and were classified by Exploratory Factor Analysis (EFA). Furthermore, the relevance of CSFs and life cycle of implementation were obtained from the expert panel. The requirements of SMEs' framework were also determined by the expert panel prior to the development of the ERP implementation framework. The proposed framework was evaluated in five case studies from SMEs in Iran. Feedback from the case studies was used to revise the framework which addressed the requirements of the ERP system implementation. The implementation cycle would consist of four phases, namely, planning, selection and design, implementation and control, and evaluation and improvement. The framework consists of relevant elements to guide the managers and implementers in attaining the success rate of ERP projects in SMEs. The future work of the current study may be directed towards testing the applicability and validity of the proposed framework in various sectors, improving the CSFs instruments, refining the relevance factors, and the stages of the implementation process.

ABSTRAK

Enterprise Resource Planning (ERP) telah digunakan dalam negara membangun untuk mengintegrasikan maklumat dan menyokong keputusan untuk pembangunan dan persaingan di peringkat global. Banyak kerangka kerja, model dan kaedah telah dicadangkan dan diaplikasikan untuk syarikat besar. Banyak Perusahaan Kecil dan Sederhana (PKS) sering kali menghadapi kesukaran ketika melaksanakan dan mengamalkan sistem ERP sehingga menyebabkan kegagalan. Tujuan kajian ini adalah untuk merumuskan satu kerangka kerja baru bagi PKS dalam pelaksanaan projek ERP dengan mengambil kira pandangan kerangka kerja syarikat dan faktor-faktor kejayaan kritikal untuk bertindak sebagai landasan untuk meningkatkan tahap kejayaan projek. Kadar kepentingan faktor-faktor kejayaan kritikal dari projek ERP ditentukan dengan menggunakan kajian literasi dan borang soal selidik. Selain itu, kaitan faktor-faktor kejayaan kritikal dan kitaran hidup implementasi diperolehi daripada panel pakar. Spesifikasi kerangka ditentukan daripada panel pakar sebelum implementasi pembangunan kerangka kerja ERP. Kerangka yang dicadangkan dinilai dalam lima kajian kes dari PKS di Iran. Maklum balas dari kajian kes digunakan untuk mengembangkan kerangka kerja yang memenuhi semua keperluan implementasi sistem ERP. Kitaran pelaksanaan terdiri daripada empat fasa iaitu perancangan, pemilihan dan reka bentuk, pelaksanaan dan pengendalian, dan penilaian dan pembaikan. Rangka kerja ini terdiri daripada semua unsur-unsur yang berkaitan untuk membimbing pengurus dan pelaksana dalam mencapai kadar kejayaan projek-projek ERP dalam PKS. Kajian masa hadapan bagi kajian ini boleh terarah kepada menguji kesesuaian dan kesahihan rangka kerja yang dicadangkan dalam pelbagai sektor, memperbaiki instrumen faktor-faktor kejayaan yang kritikal dan penapisan faktor-faktor yang berkaitan, dan peringkat-peringkat proses pelaksanaan.

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LIST OF ABBREVIATIONS

SMEs	-	Small and Medium Sized Enterprises
ERP	-	Enterprise Resource Planning
EA	-	Enterprise Architecture
EAF	-	Enterprise Architecture Framework
EFA	-	Exploratory Factor Analysis
IS	-	Information System
IT	-	Information Technology
ICT	-	Information and Communication Technology
PERA	-	Purdue University Reference Architecture
TOGAF	-	The Open Group Architecture Framework
ADM	-	Architecture Development Method
GERAM	-	Generalized Enterprise Reference Architecture and Methodology
GERA	-	Generic Enterprise Reference Architecture
EA^3	-	Enterprise Architecture Cube
ZF	-	Zachman Framework

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CHAPTER 1

INTRODUCTION

1.1 Background of the Research

Enterprise Resource Planning (ERP) has been widely used in developed countries to integrate the information and to support decision making to achieve process improvement and competition in global market. Davenport (2004) predicted that ERP is an inevitable requirement for performance in the 21st century. There are some crucial drivers for ERP implementation, such as improving the business operations, integration of processes, reducing operational costs, making business decisions and supporting customer responsiveness. The ERP system providers are now trying to extend their market to companies in developing countries, Small and Medium-Sized Enterprises (SMEs), and different kinds of industries while preparing ERP systems. However, ERP systems of SMEs in developing countries are in the early stages. There are significant barriers facing SMEs in developing countries such as limitation of financial resources, human resources, poor management base and lacking of Information Technology (IT) experts.

Therefore, many SMEs often encounter several difficulties when implementing and adopting ERP systems (Adam and O'Doherty, 2003; Blili and Raymond, 1993; Buonanno *et al.*, 2005; Čelar *et al.*, 2011; Dixit and Prakash, 2011; Doom *et al.*, 2010; Esteves, 2009; Ghobakhloo *et al.*, 2011; Haddara and Zach, 2011; Juell–Skielse, 2006; Poba-Nzaou *et al.*, 2008; Raymond and Uwizeyemungu, 2007; Snider *et al.*, 2009; Snider, 2004; Upadhyay *et al.*, 2010; Upadhyay *et al.*, 2011a;

Upadhyay and Dan, 2008; Upadhyay *et al.*, 2011b; Walsh *et al.*, 2010). Sometimes these SMEs fail to achieve the full potential efficiency and benefits of these systems which can improve the productivity and quality of decision making in these firms.

There is much research on ERP systems in developed countries but there is a scarcity of ERP systems in SMEs of developing countries. ERP implementation in SMEs is a crucial issue for academic researchers and practitioners who need a simple, comprehensive and appropriate framework to justify ERP systems thus ensuring the achievement of full potential efficiency and benefits.

Whereas numerous frameworks, models and methods have been proposed and applied by practitioners and researchers, most popular ones are based on software project implementation methods (Ehie and Madsen, 2005; Otieno, 2008; 2010; Zhang *et al.*, 2003; Zhang *et al.*, 2005). However, the current frameworks do not cover the requirements of ERP implementation lacking the necessary specifications of SMEs framework. Despite the preponderance of Enterprise Architecture Frameworks (EAFs) (Minoli, 2008; Saha, 2007; Schekkerman, 2004; Zachman, 2006; Zachman, 1996) for different purposes, none of them is easily implementable, comprehensive and suitable to be used as a purposeful framework for ERP implementation in SMEs. Furthermore, there are a number of studies which identify and evaluate the Critical Success Factors (CSFs) of ERP systems. Nevertheless, most of these studies have been conducted in developed countries and large enterprises. Therefore, the need for investigating SMEs in developing countries is inevitable.

Regarding the complexity and enterprise-wide nature of ERP projects, practitioners and researchers suggest the application of frameworks to provide a step by step guideline to clarify the implementation, evaluation and documentation of ERP processes (Chan, 2008; Ehie and Madsen, 2005; Heydariyeh *et al.*, 2012; Jing and Qiu, 2007; Kale *et al.*, 2007; Myers, 2003; Otieno, 2010; Somers and Nelson, 2001; Somers *et al.*, 2000; Zachman, 2010; Zhang *et al.*, 2005).

To prevent the failure and to improve the success rate of the ERP implementation, a comprehensive framework needs to be established whereby the

critical factors for successful implementation of ERP projects are delineated (Chan, 2008; Ehie and Madsen, 2005; Otieno, 2010).

The SMEs specifications, CSFs of ERP implementation and important issues of Enterprise Architecture Framework (EAF) were not considered in previous frameworks. Enterprise architecture and CSFs for ERP systems should also be contemplated while developing the framework in SMEs. The framework developed for the implementation of ERP systems can contribute to the current knowledge base through consideration of the EAF approach and critical success issues.

This study proposes a framework for implementing ERP systems in SMEs. This framework was validated in the case of Iranian SMEs to fulfill the specifications.

1.2 Statement of Problem

The problem investigated in the present research can be discussed from several perspectives. Firstly, ERP is one of the most important systems in the market to help companies to achieve their business objectives and to be strong enough in the competitive market. However, some difficulties and problems such as the enterprise-wide nature of the ERP and their discount of some CSFs affect the implementation of ERP systems. ERP failures can be attributed more to implementation rather than to software and hardware approaches. Regardless of the size of the firms, implementing an ERP system is one of the most challenging projects for any company. It should be mentioned that success in ERP project implementation does not come effortlessly and its benefits and return on investment are not immediately accessible. Rather, efficiency and benefits are obtained in the long time (Gargeya and Brady, 2005).

Secondly, most of the known challenges facing ERP systems adaptation and use are mainly experienced in the developed world. There are a few empirical research studies on ERP implementation which focus on SMEs in developing countries (Asemi and Jazi, 2010; Fathian *et al.*, 2008; Ghobakhloo *et al.*, 2011).

Thirdly, in comparison with Information Systems (ISs) research and other academic fields, theories on ERP system implementation have received less attention and most publications in the field of ERP systems implementation do not fully provide theoretical support (Zhang *et al.*, 2005).

Fourthly, because of the numerous differences between SMEs and large enterprises, the models, methods and frameworks developed for large enterprises are often not applicable to SMEs (Dandridge, 1979; Deros *et al.*, 2006; Radas and Bozic, 2009).

Finally, the Information and Communication Technology (ICT) development plan which defined the long term ICT operational planning and priorities of Iran from 2002 emphasized IT deployment in all sectors where one of the main aims is to support IT development through Iranian SMEs (Fathian *et al.*, 2008). Furthermore, Iran is one of the pioneering developing countries where the implementation rate of the ERP systems has recently been increasing (Nikookar *et al.*, 2010). In addition, because of the sanctions imposed by European countries and United States, the foreign ERP system providers are not interested in having agents to do business with Iranian companies. It also seems that the global ERP systems might not be economically justified in implementing ERP in Iranian SMEs, so the local providers of the software have tried to design and implement the needed ERP systems (Nikookar *et al.*, 2010).

The implementation of ERP systems is very expensive and time consuming. So, a comprehensive operational framework, as a guideline for implementation of ERP systems in SMEs, is needed to prevent the project failures.

1.3 Objectives and Scope of the Research

Regarding the advantages and needs of ERP systems in SMEs, implementation of ERP systems is complex and enterprise-wide. Thus, the existence of a framework for the implementation of ERP systems in SMEs of Iran as a developing country is seriously needed.

The ultimate aim of this research is to develop a framework for implementation of ERP systems in SMEs in developing countries.

The main objectives of this study are:

i. To identify and classify the critical success factors of ERP systems in SMEs.

ii. To identify the relevance of the classified CSFs and implementation methodology stages.

iii. To develop an appropriate framework to implement ERP systems in SMEs.

The scope of the research is:

i. This study considers only Small and Medium Enterprises.

ii. This study includes both private and public SMEs in different industries (i.e. manufacturing, service, retail and education).

iii. The validation of the proposed framework by potential users as case studies.

1.4 Research Questions

Regarding the problem stated earlier and in achieving the objectives, the research work has attempted to answer the following four questions:

i. What are the critical success factors (CSFs) of ERP system implementation in SMEs?

ii. How are CSFs of ERP systems to be classified in SMEs?

iii. How are the classified CSFs and implementation methodology stages related?

iv. What is an appropriate framework for implementation of ERP systems in SMEs?

1.5 Significance of the Research

The significance of this research is:

a. For practitioners:

i. The new proposed framework can be used as a guideline for implementation of ERP systems in SMEs.

ii. It will provide guidelines to specify various activities that are necessary for the successful implementation of the ERP systems in SMEs. Besides, it can be considered as a first step for development of various ERP application modules.

b. For researchers:

The proposed framework can serve as a foundation for research to improve ERP systems in SMEs of developing countries whereby their success rate is enhanced.

1.6 Contributions of the Research

This research determines and classifies the CSFs of ERP implementation in SMEs. It also includes the specifications of the ERP implementation framework for SMEs. A comprehensive and integrated framework for implementation of ERP systems in SMEs has been proposed and the relevance of classified CSFs with implementation stages is clarified. Figure 1.1 shows a summary of the research contributions.

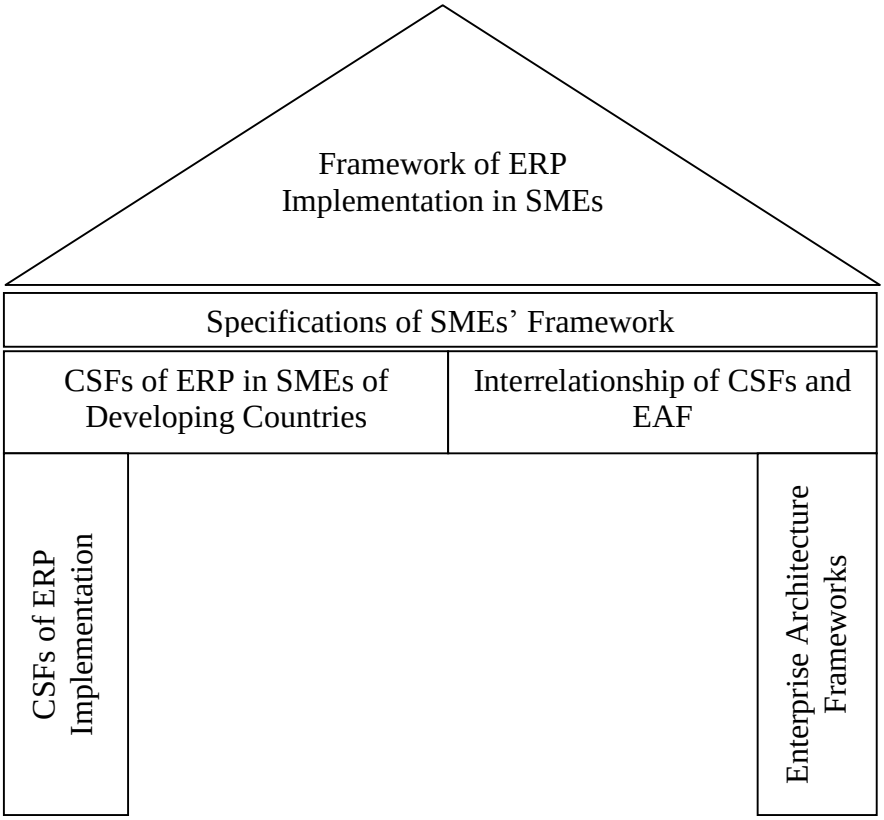

Figure 1.1 Contributions of research scheme

1.7 Thesis Structure

Contents of the thesis are organized into seven chapters. Figure 1.2 shows an overview of the research process and the corresponding chapters.

Chapter 1 focuses on the research background with regard to SMEs, ERP systems and enterprise architecture frameworks (EAFs).

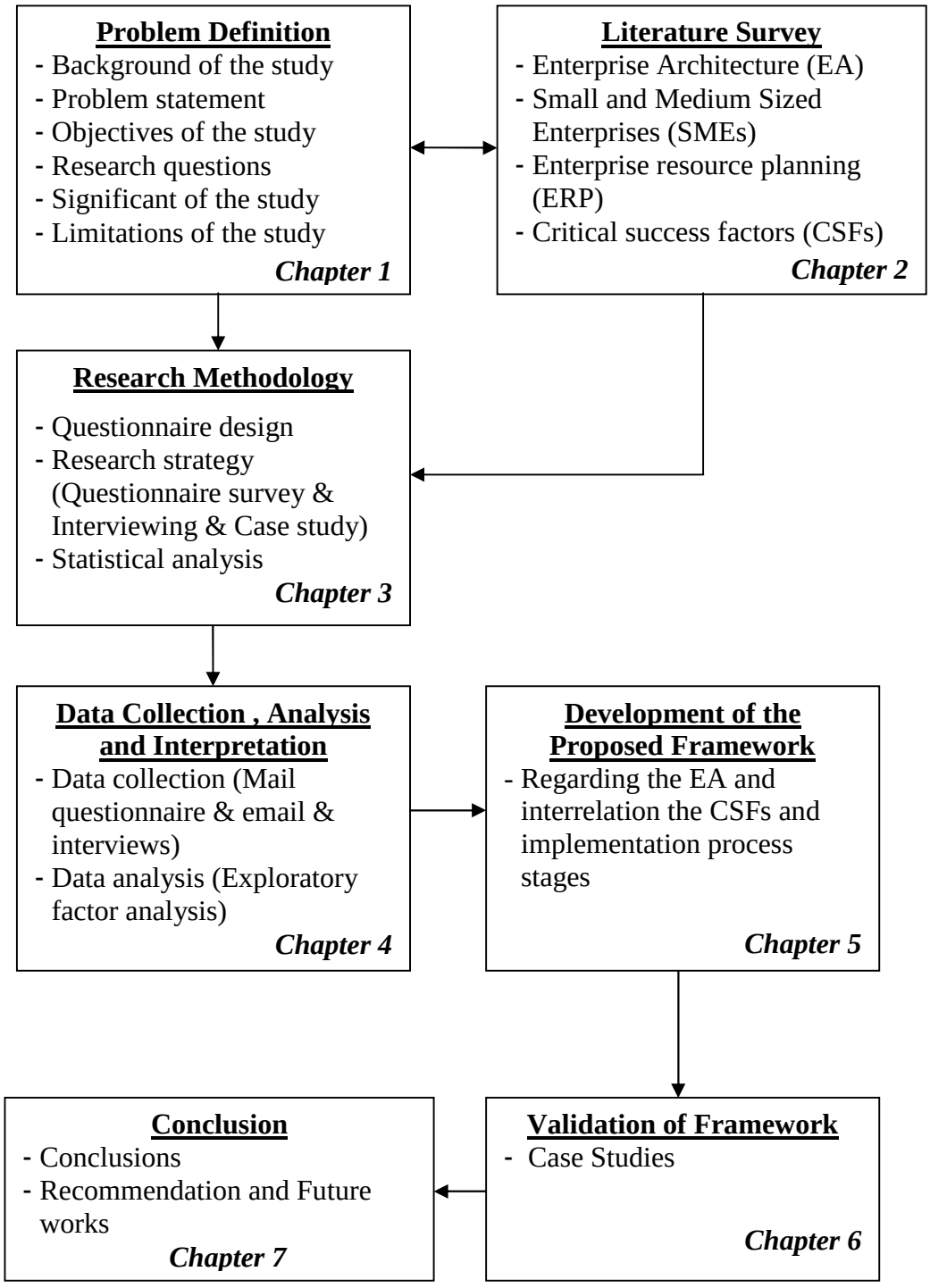

Figure 1.2 Overview of research process and corresponding chapters

The thesis continues with a review of the literature on ERP systems and critical success factors of these systems in SMEs. Also, some enterprise architecture

frameworks relevant to this research and their usage in ERP systems are discussed in Chapter 2.

Chapter 3, is incorporating the research methodology employed, both qualitative and quantitative. The validation procedure of the framework is also outlined in Chapter 3.

Chapter 4 discusses the manner in which data are collected and analyzed and specifications of SMEs' framework are identified. Chapter 5 takes up the development of proposed framework and the interrelation of CSFs and implementation process stages. This is followed by the discussion on validation and revision of the proposed framework within the case-study companies in Chapter 6. Finally, Chapter 7 presents some conclusions and recommendations for future studies.

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